effect a given result. In order to produce this rise in temperature a heat flow must be established by a temperature differential.

In many cases it is necessary that the products of combustion leave the heating chamber at a temperature higher than the ruling temperature. This is the case in the open-hearth furnace, the steam boiler, etc. One of these is such a high-temperature operation that it is necessary to preheat the air and frequently the fuel supply in order to attain the high temperature at which the waste gases leave the chamber, while waste heat boilers can be advantageously employed to recover heat leaving the regenerator chambers. The steam boiler is a low-temperature heat application and for that reason permits a greater heat utilization than is possible in a high-temperature process; at the same time it is frequently found desirable to pass the gases leaving the boiler through an appliance which recovers heat and returns it to the boiler in the shape of hot feed-water or preheated air supply. The foregoing methods of preheating the air and fuel supply or the waste heat boiler are indirect methods of heat recovery, while the heating of the feed water or the preheating of material as it is moved from a low temperature to a higher temperature zone in the same furnace are direct methods of heat recovery. The indirect methods involve a greater inherent heat loss than the direct methods. High-temperature operations and processes cannot be accomplished without considerable loss of heat. The lower the temperature required for an operation or process the greater the possibility of reducing the heat loss to a minimum by utilizing the maximum amount of the heat released in the operation itself. At the same time the very ease with which the low-temperature operation may be accomplished leads

to a very superficial study of its possibilities. Therefore such operations are notorious for their wasteful utilization of the heat and fuel.

It is hardly necessary to state that intermediate conditions between those plotted on the curve may be obtained by proportion. In the same manner other values for preheat may be established by the use of dividers and graphical addition; that is, the curves permit the making of numerous approximations, giving a relative idea of what may be expected from any fuel, a base for the comparison of the results which may be obtained by the substitution of one fuel for another> However, it is very important to bear